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VERIFICATION TESTS OF THE JET INDUSTRIES ELECTRA VAN 600.(U)
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Report 2316

VERIFICATION TESTS OF THE JET INDUSTRIES ELECTRA VAN 600

by
Edward J. Dowgiallo, Jr.
Ivan R. Snellings
William H. Blake

December 1980

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The Jet Industries Electra Van 600 is a Subaru Van which has been converted to an electric vehicle. It was tested by MERADCOM as part of a Department of Energy project to verify conformity to performance standards of electric vehicles. The Electra Van 600 test results are presented in this report. The 600 Van is powered by 17 6-volt lead-acid batteries through an SCR Controller to a series-wound 20-hp d.c. motor. It has torsion bar suspension with hydraulic shocks and is equipped with drum-type hydraulic brakes front and rear. It does not have regenerative braking.		

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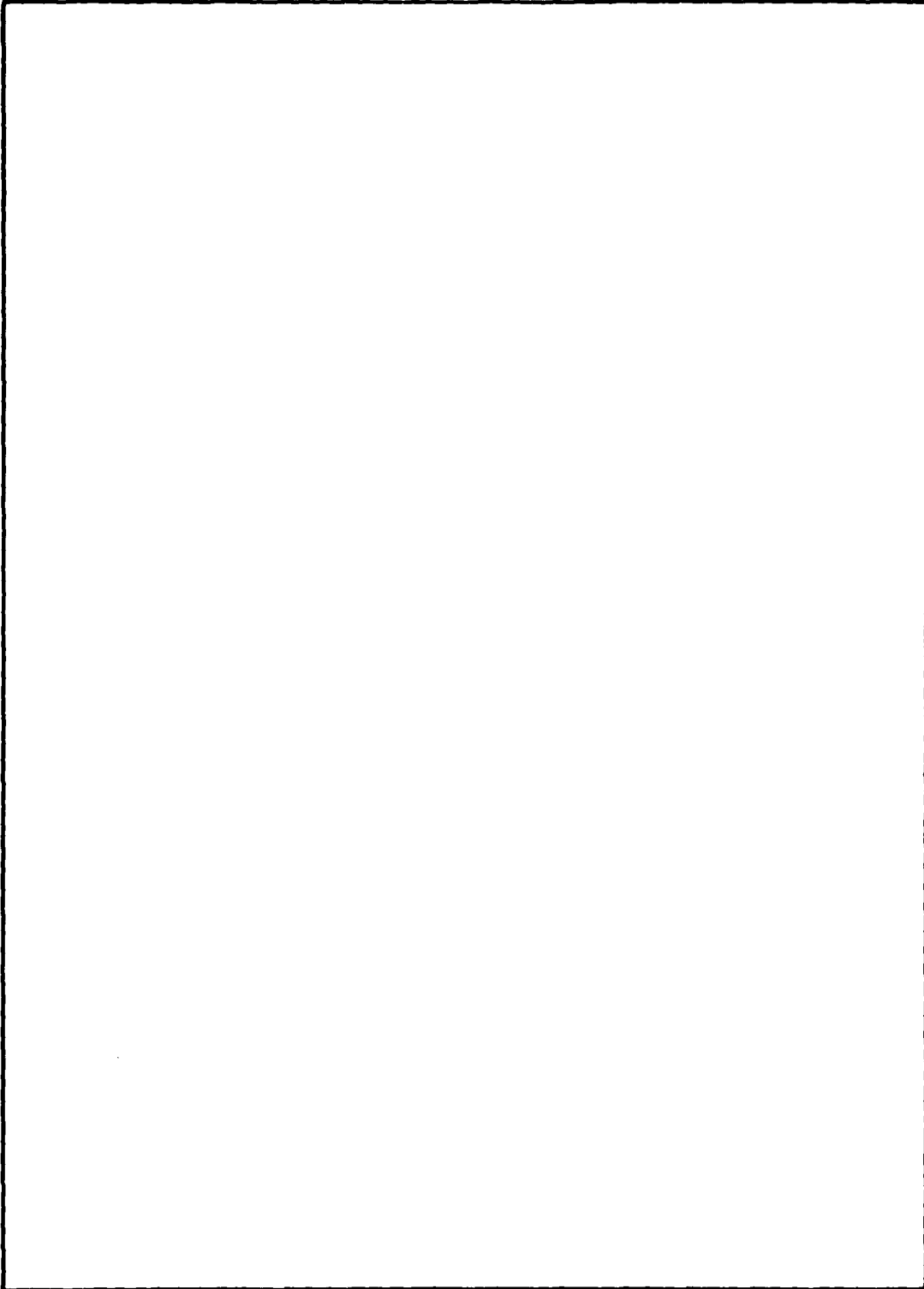
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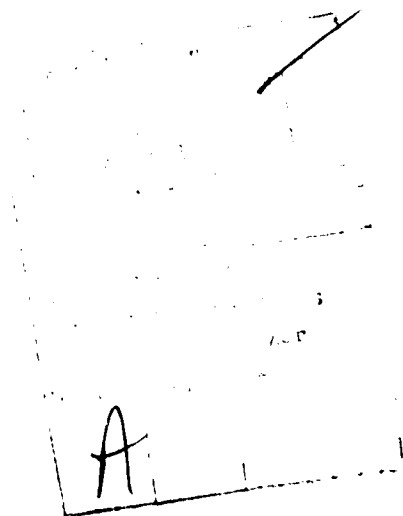
PREFACE

Michael E. Johnson, P.E., of VSE Corporation was responsible for aspects of calibration of the signal conditioning circuits and recording instruments as well as data tabulations, and preparation of the report.

James A. Queen and Calvin T. Bushrod of the Environmental and Field Division, Product Assurance and Testing Directorate, assisted in vehicle operation and data collection.

The report was prepared to document work sponsored by the United States Government. Neither the United States nor its agent, the United States Army, nor any Federal employees, nor any of their contractors, sub-contractors, or their employees, makes any warranty, express or implied, nor assumes any legal liability to responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights.

The view, opinion, and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other documentation. This vehicle was tested to determine its conformity to the Department of Energy, "Performance Standards for Demonstrations." The results reported herein show the nominal capability of the vehicle when it failed to meet the standards. The vehicle may exceed the performance reported herein in actual use. It also may have safety features and amenities not required by the Department of Energy Standards.



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VERIFICATION TESTS OF THE JET INDUSTRIES ELECTRA VAN 600

I. SUMMARY

The Jet Industries Electra Van 600 is a multipurpose utility electric vehicle based on a Subaru Van modified to use an electric motor and battery propulsion system. The vehicle was tested 27 July 1978 to 18 September 1978. Complete test results are contained in Section V. The test results are summarized below:

Acceleration: 50 km/h (31.1 mi/h) in 14 s.

Range: SAE J227a/B Cycle on level (\pm 1-percent) terrain: 62 km (38.5 mi)
181 cycles.

Forward Speed

Capability: Maintained 70 km/h (43.5 mi/h) for more than 5 min.

Gradeability at

Speed: At 25 km/h (15.5 mi/h) can traverse a 13.8-percent grade at
80-percent depth of discharge (DOD).

Gradeability

Limit: Vehicles should start and climb forward on a 35.6-percent grade
for at least 20 s at 80-percent DOD. Reverse gradeability has been
calculated at 34.8-percent.

II. INTRODUCTION

The Jet Electra Van 600 electric vehicle was operated to determine conformity to the Department of Energy "Performance Standards for Demonstration," published in the Federal Register, Part V, 30 May 1978. The result of testing performed by the US Army Mobility Research and Development Command (MERADCOM), as well as other descriptive data concerning the vehicle, are presented in this report.

III. OBJECTIVES

The objectives of this test were to examine the Jet Industries Electra Van 600 for suitability to those aspects of vehicle performance as outlined in the Department of Energy's Performance Standards for Demonstration.

IV. TEST VEHICLE DESCRIPTION

The Electra Van 600 vehicle is manufactured by Jet Industries, Inc.; Austin, Texas. The vehicle is an electrified Subaru Van (Figures 1 and 2). The 5-door vehicle (2 front passenger doors one on each side, 2 sliding cargo doors on either side, and a rear hatch-type door) has 16 of the 17 6-volt propulsion batteries arranged together in a pack in the cargo compartment; with the cover on, the pack forms the seat portion of the rear seat (Figures 3 and 4). The front seat is a bench type designed for 2 passengers (Figure 5). The last propulsion battery and the auxiliary battery are located, along with the Lester charger, under the cargo bed at the rear of the vehicle (Figure 6). Just forward of these batteries is the Prestolite propulsion motor, mounted transversely (Figure 7).

The instrumentation of the Jet Van 600 differs little from that of an internal combustion engine counterpart; however, those differences are important. The fuel gauge indicates the heater's gasoline fuel capacity. The temperature gauge indicates the electric motor temperature. There is a charge indicator light on the dashboard to show that the vehicle charger is connected to the utility wall power. An emergency disconnect switch to the left of the steering post allows emergency opening of the traction circuit. Next to the light switch is a heater switch to start the gasoline-fired heater, and finally the state-of-charge meter and the ammeter show the propulsion battery status (Figure 8).

The Jet Electra Van 600 has a curb weight of 1,261 kg (2780 lb) and can carry 295.4 kg (650 lb) including driver and payload, giving a gross vehicular weight of 1,559 kg (3430 lb). The vehicle is 3.17 m (10.4 ft) long, 1.37 m (4.5 ft) wide, and has a wheelbase of 1.73 m (5.7 ft).

The Electra Van 600 has a four-speed (forward) transmission and is equipped with standard equipment such as heater and defroster, windshield wipers and washers, speedometer, odometer, ammeter, and state-of-charge meter. The heater is an Espar B1L gasoline heater with a 5,000-Btu/h output rating.

The propulsion system consists of 17, SGL model 2HGC-HC, 6-volt batteries rated at 125-Ah capacity, a Cableform SCR controller, rated at 350 A, 84 to 140 V, and a Prestolite series-wound d.c. motor which can provide 20 hp at 4900 r/min. The auxiliary 12-volt battery, which powers lights and accessories, is an SGL 100-Ah battery.



Figure 1. Electra Van 600, front oblique view.



Figure 2. Electra Van 600, rear oblique view.

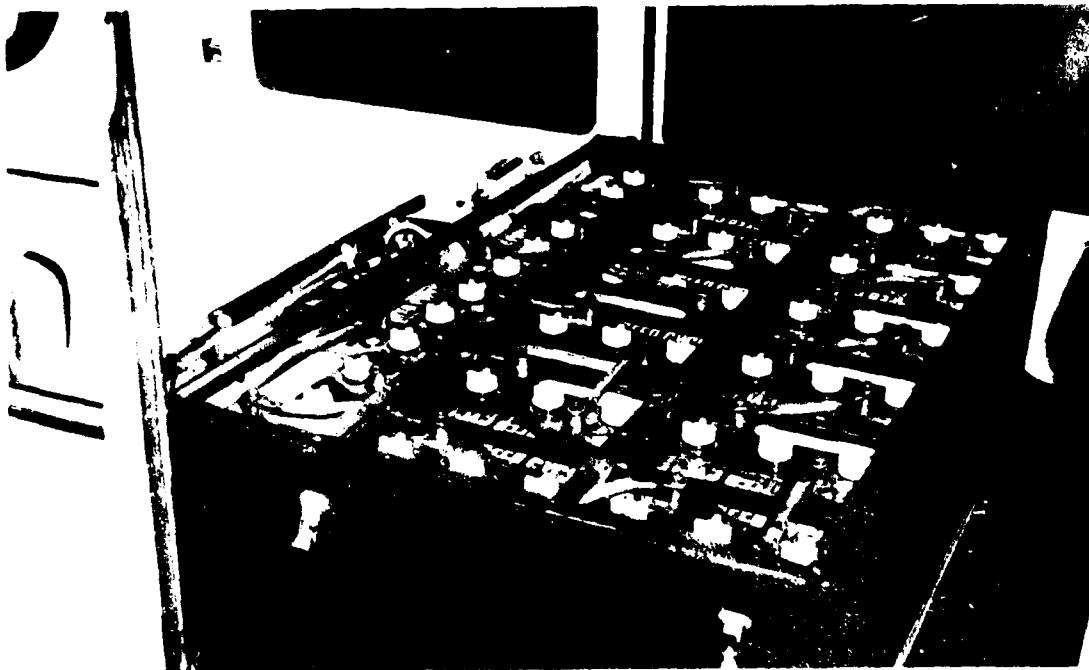


Figure 3. Main propulsion batteries, side view.



Figure 4. Main propulsion batteries, rear view.

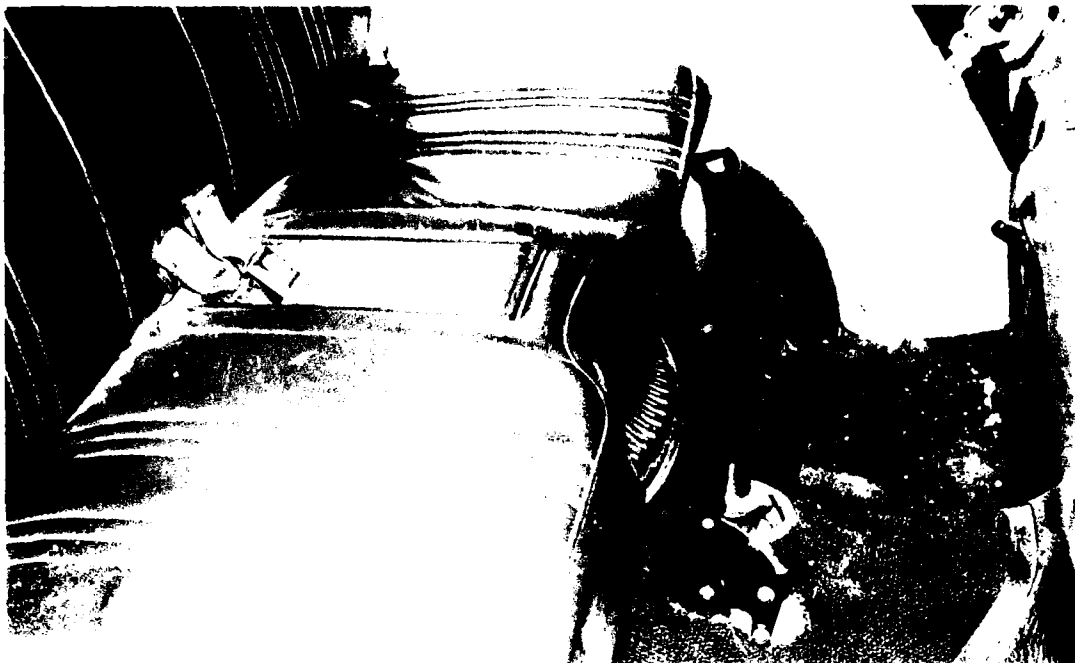


Figure 5. Front seat (note spare tire and stick shift).

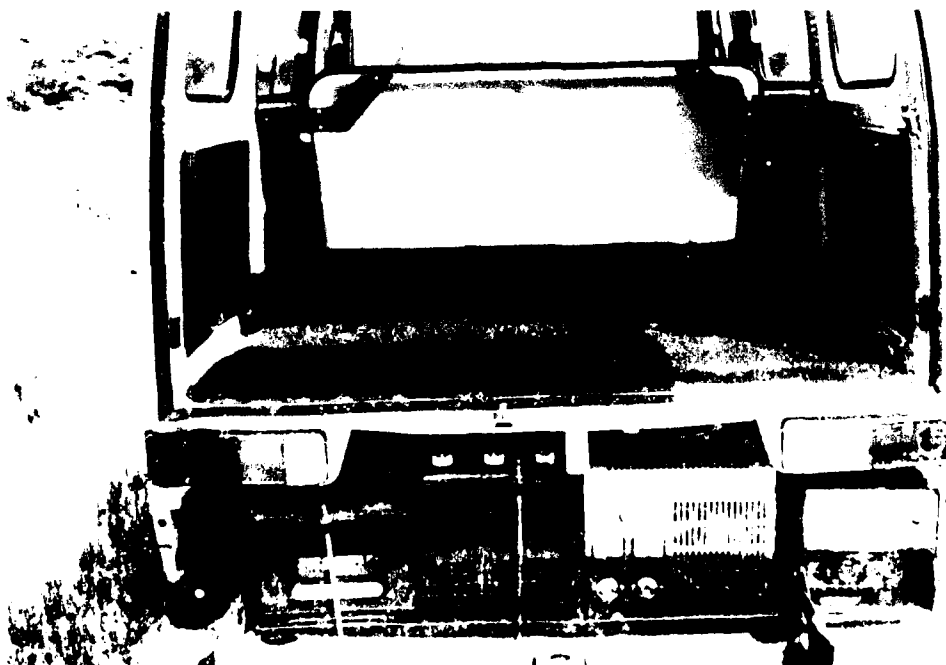


Figure 6. Auxiliary battery, propulsion battery, and charger.

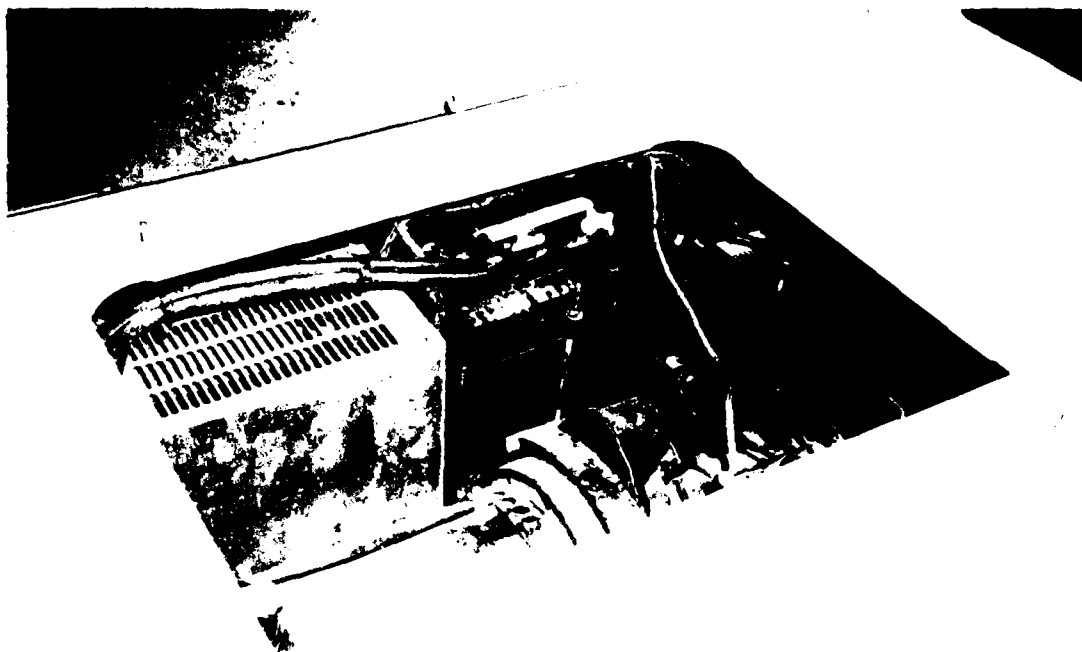


Figure 7. Main propulsion motor.

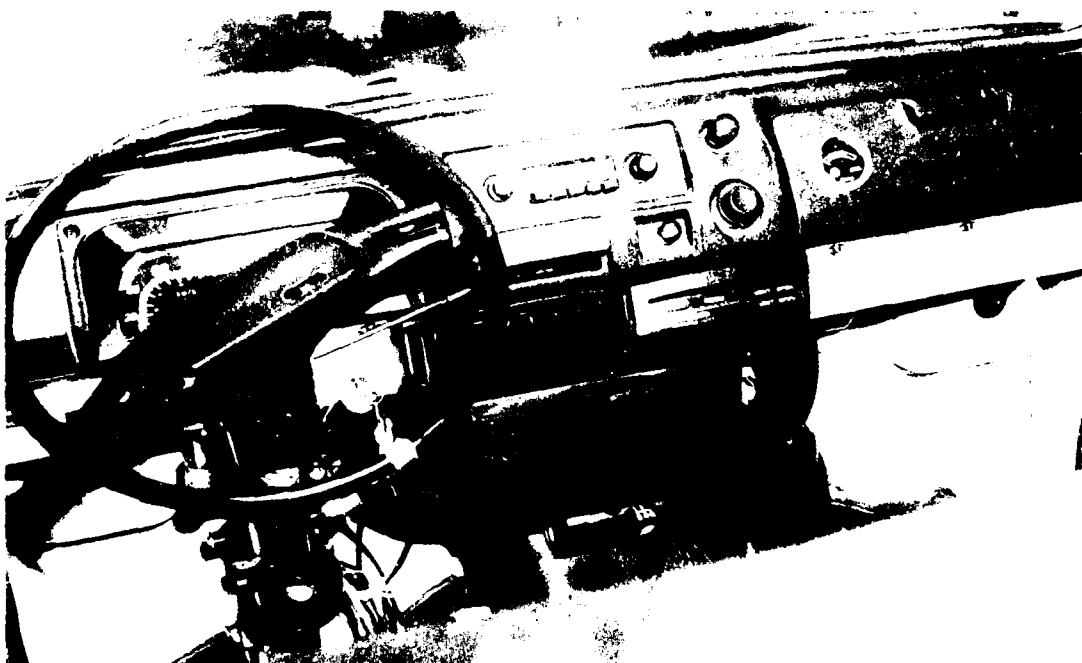


Figure 8. Instrument panel.

The battery charger for the vehicle is an on-board Lester charger, accepting either 110 or 220 V.a.c. input, rated at a peak output current of 30 A and with automatic cutoff. The vehicle tires are Bridgestone 4-ply radials, six 500-10 inflated to 310 kPa (45 lb/in²) (see Appendix A for Vehicle Data Summary Sheet).

V. TEST RESULTS

The following are the complete results of the testing performed on the Jet Industries Electra Van 600, from 27 July 1978 to 18 September 1978. Paragraphs are referenced to the DOE's Performance Standards for Demonstration Criteria (Appendix B). See Appendix C for verification procedures.

- a. **Acceleration.** 50 km/h in 14 s.
- b. **Gradeability at speed.** At 25 km/h can traverse a 13.8-percent grade based on calculation from acceleration tests at 80-percent depth of battery discharge (DOD).
- c. **Gradeability limit.** Vehicle should start and climb, forward, a 35.6-percent grade for at least 20 s based on drawbar pull tests at 80-percent DOD. Reverse gradeability calculated at 34.9 percent, based on 1st forward gear ratio of 4.363:1 and reverse gear ratio of 4.272:1.
- d. **Forward speed capability.** Maintained 70 km/h for 51 min on MFRADCOM test track with a 5-percent grade.
- e. **Range.** SAE J227a B cycle on level (± 1 -percent) terrain, 62 km and 181 cycles.
- f. **Battery recharge time.** After an 80-percent discharge, recharged with Lester Battery Charger Model 9222 on board the vehicle for 10 h; after recharge, vehicle operated for more than 50 km to an SAE J227a/B cycle regime.
- g. **Recharge control.** Voltage comparator.
- h. **Energy consumption.** Only nonelectrical energy use is the optional gasoline-fueled heater.
- i. **Battery life.** Warranty period of 18 mo. Battery SGL type 2HGL-HC battery consisted of 51 cells connected in series in 17 modules; nominal voltage was 102 V.

- j. **State-of-charge meter.** Yes.
- k. **Odometer.** Yes
- l. **Passenger comfort heater.** Optional.
- m. **Documentation.** Yes
- n. **Emissions.** Did not evaluate.

o. **Safety.** The Department of Transportation is performing these evaluations; however, MERADCOM performed the following limited checks:

(1) **Electrical isolation.** The electrical propulsion circuit is isolated by design; however, voltages above 50 V capable of sustaining currents greater than 60 ma were measured from a battery terminal to the frame. Mild electrical shocks to personnel occurred when the battery cases were touched when specific gravities were being measured. Battery manufacturers claim that leakage currents and voltages are conducted through acid vapors which have condensed on the battery cases during charge and discharge.

(2) **Safety Standards 208 and 301.** The Department of Transportation will check compliance.

(3) **Battery caps are standard golf-cart industry types.** Flame-barrier characteristics were not tested.

(4) **Ventilation of battery compartment.** The battery compartment is forced-air ventilated during charge to carry off hydrogen oxygen gases and any small amounts of acid vapor generated. The fans continue to run after charging to allow residual hydrogen gases to dissipate.

(5) **Battery emergency disconnection.** This consisted of a manually activated mechanically linked disconnect switch. Also a 250-A fuse in the battery current loop.

(6) **Parked temperature effect.** Parked vehicle for two 8-h periods at temperatures of -25°C and 50°C. Subsequent operation revealed no apparent damage to the vehicle or hazard to persons.

VI. CHRONOLOGY OF VEHICLE FAILURES

The following failures occurred:

<u>Date</u>	<u>Failure or Problem</u>	<u>Corrective Action</u>
1 August 1978	Auxiliary battery charging circuit shorted to main battery charging circuit.	Replaced shorted wires.
23 August 1978	Burned-out clutch	Replaced clutch (150 lb pressure).
24 August 1978	Burned-out clutch	Replaced clutch and pressure plate w/heavy-duty unit (180 lb pressure).

APPENDIX A

VEHICLE DATA SUMMARY SHEET

1. Vehicle Manufacturer:

Jet Industries, Inc.
7101 Burleson Rd.
Austin, Texas 78745
512-385-0660

2. Vehicle Description:

Name: Electra Van
Model: 600
Availability: 30 days
Price: N/A

3. Vehicle Weight:

Curb Wt: 1260 kg (2780 lb)
Driver Wt: 68 kg (150 lb)
Payload Wt: 295 kg (650 lb)
Gross Wt: 1556 kg (3430 lb)

4. Vehicle Size:

Wheelbase: 1.73 m (6 ft)
Length: 3.17 m (10.4 ft)
Width: 1.37 m (4.5 ft)
Headroom: 0.91 m (3 ft)
Legroom: 1.10 m (3.3 ft)

5. Auxiliaries and Options:

No. Lights: 18
a. Headlights
b. Signal
c. Park

d. Backup
e. Stop
f. Side marker
g. Tail
h. Dome
i. Dash
Windshield Wipers: Yes
Windshield Washers: Yes
Defroster: Yes
Heater: Yes
Radio: Yes
Fuel Gage: Yes
Ampmeter: Yes
Tachometer: Yes
Speedometer: Yes
Odometer: Yes
No. Mirrors: 3
Power Steering: No
Power Brakes: No
Transmission Type: 4-speed manual

6. Propulsion Batteries:

Type: Lead Acid
Manufacturer: S G L
No. of Modules: 17
S/N: Mdl 2 HGC-HC
No. Cells: 51
Battery Voltage: 102 V
Ah Capacity: 125
Battery Size: 17.1 cm x 27.3 cm x 24.8 cm
(6.75 in. x 10.75 in. x 9.75 in.)
Battery Wt: 29.9 kg (66 lb)
Battery Age: New
Battery Rate: 75 A/100 min
Battery Cycles: 10 cycles

7. Auxiliary Battery:

Type: Lead Acid
Manufacturer: SGL

No. Cells: 6
Battery Voltage: 12 V
Ah Capacity: 100 Ah
Battery Size: 26.0 cm x 17.1 cm x 19.7 cm
(10.25 in. x 6.75 in. x 7.75 in.)
Battery Rate: 20 h
Battery Wt: 18.1 kg (40 lb)

8. Controller:

Type: SCR
Manufacturer: Cableform
Voltage Rating: 84-140 V
Current Rating: 350 A
Size: 58.4 cm x 12.7 cm x 20.3 cm
(23 in. x 5 in. x 8 in.)
Weight: 11.34 kg (25 lb)

9. Propulsion Motor:

Type: Series
Manufacturer: Prestolite
Insulation Class: 11
Voltage Rating: 120 V
Current Rating: 175 A
HP Rating: 20 hp
Max. 5-Min. Rating: 380 A
Size: 0.41 m L x 0.23 m Dia
(1.3 ft L x 0.75 ft Dia)
Weight: 72.5 kg (160 lb)
Rated Speed: 4900 r/min
Max. Speed: 6000 r/min

10. Body:

Type: Subaru
Manufacturer: Fuji Heavy Ind.
No. Doors: 5
Type: 3 hinge; 2 slide
No. Windows: 8
Type: Sliding
No. Seats: 2

Type: Bench
Cargo Volume: 2.18 m³ (77 ft³)
Cargo Dimensions: 1.22 m x 1.22 m
(4 ft x 4 ft)

11. Chassis:

Type Frame: Box
Manufacturer: Fuji
Type Material: Steel
Modifications: N/A
Type Springs: Torsional
Type Shocks: Hydraulic
Axle Type Front: Swing-Arm
Axle Type Rear: Swing Independent
Axle Manufacturer: Fuji
Drive Line Ratio: 4.4:1
Type Brakes Front: Drum
Type Brakes Rear: Drum
Regenerative Brakes: No
Tire Type: 4-ply Radials
Manufacturer: Bridgestone
Pressure: 310.2 kPa (45 lb/in²)
Rolling Radius: N/A

12. Battery Charger:

Type: Ferro-resonant
Manufacturer: Lester
On- or Off-board: On
Input Voltage: 110/220 V.a.c.
Peak Current: 30 A
Recharger Timer: Automatic
Size: 21.0 cm x 14.6 cm x 20.3 cm
(8.25 in. x 5.75 in. x 8 in.)
Weight: 9.07 kg (20 lb)
Automatic Turn Off: Yes

APPENDIX B

PERFORMANCE STANDARDS FOR DEMONSTRATIONS

FEDERAL REGISTER

30 MAY 1978

PART V. SUBPART B

475.11 Minimum levels of performance for commercial vehicles.

The following minimum levels of performance are required with respect to any commercial vehicles purchased or leased pursuant to section 7 (c) of the Act.

(a) **Acceleration.** The time required to accelerate from rest to 50 km/h shall not exceed 15 s.

(b) **Gradeability at speed.** The grade which can be traversed up at 25 km/h shall be at least 10 percent.

(c) **Gradeability limit.** The grade on which the vehicle can start and climb for 20 s either backward or forward shall be no less than 20 percent.

(d) **Forward speed capability.** The speed which can be maintained for 5 min shall be 70 km/h.

(e) **Range.** The distance which the vehicle can be operated with vital accessories on or equivalent shall be:

- (1) For an electric vehicle, at least 50 km on the SAE J227A/B cycle, and
- (2) For a hybrid vehicle, at least 200 km on the SAE J227a B cycle.

(f) **Battery recharge time.** The vehicle shall be capable of satisfying the range requirement of 475.11 (e) above, after being recharged for no more than 10 h. At the start of this recharge, the vehicle shall have 80 percent discharged batteries as specified by the vehicle test conditions and procedures of 475.3

(g) **Recharge control.** The vehicle shall have a recharge control which is adequate to meet the requirements of energy, life, and safety as such requirements are stated by these performance standards.

(h) **Energy consumption:**

(1) For an electric vehicle, the maximum amount of nonelectrical energy consumed shall be that used for operation of the accessories only.

(2) For a hybrid vehicle, nonelectrical energy consumed shall not exceed 9.8 kJ/kmkg of cargo and shall also not exceed 75 percent of total energy consumed for propulsion and vital accessories, based on being fully loaded on a driving schedule of 100 km on SAE J227a/V cycle, the cargo not including the operator, and with vital accessories on.

(i) **Battery life:**

(1) The vehicle shall be capable of at least 75 percent of the range specified in 475.11 (c) after 12 mo or 15,000 km of normal use, whichever occurs first.

(2) The vehicle shall be capable of 100 percent of the acceleration and gradeability specified in 475.11 (a), (b), and (c), for all test conditions and procedures specified by 475.3, for 12 mo or 15,000 km of normal use, whichever occurs first.

(3) The batteries shall, if necessary, be repaired or replaced by the vehicle manufacturer at no cost to the user of the vehicle in order to meet requirements of (1) and (2) of 475.11 (i).

(j) **State-of-charge meter.** The vehicle shall have a state-of-charge meter for the propulsion battery system or other means of providing an indication of remaining range.

(k) **Odometer.** The vehicle shall have an odometer.

(l) **Passenger comfort heater.** The vehicle shall have a passenger comfort heater available as an option.

(m) **Documentation.** Adequate user manuals, maintenance (service) manuals, and parts lists shall be provided.

(n) **Emissions.** The vehicle shall comply with all applicable Federal emissions regulations for motor vehicles.

(o) Safety, crashworthiness, damageability, crash avoidance, and hazards:

(1) The vehicle shall comply with all applicable Federal regulations for motor vehicles concerning safety, crashworthiness, damageability, crash avoidance, and hazards unless a waiver or modification is obtained from the Department of Transportation.

(2) Until the Department of Transportation issues regulations which cover the same subjects, the vehicles shall also have the following performance characteristics:

(i) The electric propulsion circuit shall be electrically isolated from other conductive portions of the vehicle.

(ii) The vehicle shall be capable of undergoing the test procedure of Federal Motor Vehicle Safety Standards 208 and 301 with all battery materials remaining outside the passenger compartment.

(iii) Vehicles with battery caps or battery vents shall have flame barrier provisions to inhibit battery explosions.

(iv) Ventilation shall be adequate within the battery compartment to maintain the concentration of hydrogen below 4 percent by volume during vehicle operation (including charging and maintenance).

(v) The vehicle shall have a device which provides for the positive disconnection of the battery and which is operable from the normal operator position.

(vi) The vehicle shall be capable of being parked for up to 8 h in temperatures of -25°C to 50°C and subsequently operated at any temperature within this temperature range without damage to the vehicle or hazard to persons.

APPENDIX C

ELECTRIC AND HYBRID VEHICLE VERIFICATION PROCEDURES

BACKGROUND

DOE is required by Public Law 94-413 to issue performance standards for vehicles used in the Electric and Hybrid Vehicle (EHV) Market Demonstration. On 30 May 1978, DOE published a final rule in the Federal Register (Vol. 43, No. 104) promulgating the first Performance Standards. This rule was effective on 3 July 1978 and prescribed minimum performance standards for electric and hybrid vehicles to be purchased or leased for the first phase of a demonstration program under the Electric and Hybrid Research and Development Act of 1976. Performance Standards are updated from time to time and the current rule was published in the Federal Register on 12 February 1980 (Vol. 45, No. 30).

Manufacturers who certify that their vehicles meet the latest requirements of the DOE Performance Standards may offer those vehicles for the DOE Market Demonstration Program. DOE reserves the right to verify, by independent test, the manufacturer's self-certification. The test procedures used for DOE performance tests are based on SAE Test Procedures J227a. Safety inspection and testing services are provided by the Department of Transportation/National Highway and Traffic Safety Administration (DOT/NHTSA) through an interagency agreement. Performance testing is performed by the US Army Mobility Research and Development Command (MERADCOM) through an interagency agreement. During verification testing, vehicle component or subsystem failures will be immediately brought to the attention of the manufacturer. Repeated or multiple component or subsystem failures experienced during test are grounds for invalidating the self-certification of the vehicle for purpose of the DOE Market Demonstration Program.

CERTIFICATION PROCESS

A manufacturer can certify an existing vehicle as meeting the DOE Standards (which include applicable NHTSA safety standards by reference) at any time by submitting a letter of certification and providing the required data on the vehicle to the Department of Energy Director of Electric and Hybrid Vehicles Division or his designee. (See flow chart for certification and verification procedures.)



VERIFICATION PROCESS

Should DOE elect to verify the certification, arrangements will be made with the manufacturer for delivery of the vehicle to a DOE-specified site for testing. (Details of scheduling priorities are described in the following section.) Several basic types of tests may be involved:

- DOE-Sponsored Performance Tests by the US Army MERADCOM.
- DOE-Sponsored Safety Inspection by DOT/NHTSA.
- DOE-Sponsored Safety Compliance Testing by the Research Division of DOT/NHTSA.
- DOT/NHTSA Safety Compliance Test (Independent of DOE).

One important principle followed by DOE during testing is to allow the Facility Manager to work with manufacturers to overcome the normal problems that occur during inspection and testing. To ensure impartial treatment of manufacturers during the test sequence, limits have been set for the Test Facility Manager concerning how many vehicle component or subsystem failures can be allowed before certification is invalidated. DOE will objectively evaluate the impact of all failures during the testing phase so that vehicles are not unfairly penalized for minor and easily correctable failures. The Test Facility Manager, however, has an obligation to conduct the testing thoroughly and to adhere to a tight schedule.

Manufacturers may be notified from time to time by the Test Facility Manager of potential and actual problems. When these problems do not involve components or subsystem failures, where failure is defined as a vehicle being below the required standard, such notification would not necessarily invalidate the certification.

TEST FACILITY SCHEDULING GUIDELINES

Vehicles will be scheduled for testing by the Test Facility Manager on a first-come, first-served basis, with certain exceptions as noted below. Scheduling is dependent upon the ability of the manufacturer to provide a vehicle for testing. The Test Facility Manager will request the manufacturer to provide a certified vehicle for testing within 60 days from the date of the request. If a vehicle is not received at the Test Facility within the 60-day period, the self-certification will be returned and the vehicle will be removed from the self-certification list.

The primary function of certification testing is to ensure that vehicles available to the Market Demonstration Program fully satisfy the applicable DOE Performance Standards. For this reason, it is necessary to establish a set of priority-testing categories for vehicles selected or being considered for selection by demonstration site operators. The categories are listed below in decreasing order of priority for testing:

1. Certified vehicles which have not been verified but have been purchased by and delivered to site operators.
2. Certified vehicles purchased by but not delivered to site operators for demonstration.
3. Certified vehicles that have been modified subsequent to verification testing and have been delivered to site operators.* On request by DOE, the manufacturer will furnish DOE with technical information about each modification in sufficient detail to determine if reverification tests are needed.
4. Certified vehicles that are being considered for purchase by a site operator.
5. Certified vehicles that are available for test but are not under consideration by a site operator.

Vehicle test schedules are sensitive to the requirements of the Market Demonstration Program, and rescheduling by the Test Facility Manager may be required to meet changing needs. Vehicles delivered late or taken out of test because of operational failure may be rescheduled on a lower priority basis by the Test Facility Manager with approval of the DOE Test Manager. On-site rectification of a vehicle problem by the manufacturer within a 5-working-day period described below may avoid the necessity for rescheduling.

VEHICLE MODIFICATION/REPAIR GUIDELINES

The guidelines provided in this section are for use by the Test Facility Manager. Exceptions to these guidelines require the approval of the Director of the DOE Electric and Hybrid Vehicle Division or his designee. The intent of these guidelines is to facilitate the establishment of a clear basis for validating or invalidating a manufacturer self-certification. Subsystem failures may raise questions as to the relevance of

* The manufacturer is responsible for notifying the DOE Director of the Electric and Hybrid Vehicle Division or his designee of all modifications to the verified production configuration.

the results of the validation testing. It is also important that the test facilities not be used for development and test engineering. Vehicles that experience repeated failures of the same component or subsystems must be upgraded before verification testing can be rescheduled. Rescheduling will be contingent on the submission and acceptance of evidence, obtained by the manufacturer through testing, that the cause of failure has been corrected. The Test Facility Manager will determine when significant repairs should be and have been made.

VEHICLE MODIFICATIONS/REPAIRS ON OR NEAR THE TEST FACILITY

A. Only those modifications or repairs that can be completed within 5 working days by the manufacturer or his designee will be allowed. If the repairs cannot be completed within this period, the vehicle must be removed from the test facility unless DOE programmatic requirements dictate that it is in the best interest of the Government that a waiver be granted by the Director of the Electric and Hybrid Vehicles Division or his designee.

B. All failures requiring repair, whether significant or insignificant, will be recorded by the Test Facility Manager or his designee. For all repairs the manufacturer must submit (to the Test Facility Manager) written explanation of the failure modes and the corrective action taken within 15 days after completion of corrective action. Failed components or subsystems must be replaced by an identical part except in those cases where the component or subsystem design is inadequate. In the latter case, the manufacturer may substitute a readily available component or system when the manufacturer can provide assurance of improved reliability and performance.

C. Three on-site repairs to correct a significant powertrain failure are allowed. A fourth failure will invalidate the vehicle certification, and the Facility Manager will order the vehicle to be returned to the manufacturer unless DOE programmatic requirements dictate that a waiver be granted by the Director of the Electric and Hybrid Vehicles Division or his designee.

D. Subject to overriding priority considerations, testing will be resumed as soon as repairs are completed.

VEHICLES RETURNED TO THE MANUFACTURER BECAUSE OF FAILURE IN TEST

A. A letter invalidating the certification will be issued to the manufacturer and DOE will notify site operators of the invalidation. A report including the vehicle failures will be provided by DOE to members of the public requesting such a report. Vehicles that

are part of the Market Demonstration Program (based on the manufacturer's self-certification) which fail the verifications tests will have their certifications invalidated until successful correction of the defects is completed. Future funding to site operators for the invalidated vehicle model will be suspended until corrections are completed.

B. A one-time voluntary withdrawal of a vehicle from test by a manufacturer to correct problems is allowed for a period not to exceed 60 days. The vehicle will be rescheduled for testing based on priorities at the time of resubmittal. No action will be taken to invalidate the certification during the voluntary withdrawal period unless there is a clear case of user safety involved or the manufacturer fails to offer the vehicle for test after 60 days.

C. Before a vehicle can be resubmitted for testing, the manufacturer must provide to the Director of the Electric and Hybrid Vehicles Division, or his designee, appropriate evidence that modification and/or repairs have been made. The manufacturer must also provide substantiating test data to show that the vehicle can meet all DOE Performance Standards.

D. Repaired vehicles returned by the manufacturer may be required to undergo the complete series of verification tests regardless of the portion of testing completed prior to invalidation of certification. The Test Facility Manager with the approval of DOE, will determine the necessity for such retesting.

GROUND FOR INVALIDATING CERTIFICATION

1. A vehicle will be returned to the manufacturer after four significant powertrain failures or a single powertrain failure that cannot be corrected, and its certification will be invalidated.
2. A vehicle that fails to meet applicable DOE Performance Standards will have its certification invalidated. (The standards include documentation and warranty provisions.)
3. A vehicle that fails to comply with applicable DOT/NHTSA Safety Regulations will have its certification invalidated.
4. If a manufacturer fails to commit to and follow a reasonable schedule (defined in the following section) to provide a vehicle for testing when requested by DOE, the vehicle will have its certification invalidated.

SUMMARY OF RESPONSIBILITY OF MANUFACTURERS

Manufacturers must self-certify their production vehicles to participate in the DOE Market Demonstration Program. They must also commit to a reasonable schedule to provide a vehicle for verification testing upon request from the DOE designated Test Facility Manager. If this delivery cannot be made within 60 days after receipt of such a request, the self-certification letter will be returned and the vehicle be removed from the self-certified list.

Manufacturers must provide required and necessary information to document the vehicle configuration:

- Vehicle Summary Data Sheets,
- Operator's Manual, and
- Service and Maintenance Manual including a parts list.

This information may be in draft form, but it must be complete enough to be useful should any mechanical or electrical difficulty develop in the vehicle.

The manufacturer will notify the Director of the Electric and Hybrid Vehicles Division or his designee of all modifications to previously verified production configurations within 30 days of the sale of such modified vehicles to DOE site operators. If it is requested, the manufacturer shall furnish the DOE Test Manager with technical information about each modification in sufficient detail to determine if reverification tests are needed.

For vehicles receiving an invalidation of certification, the manufacturer must provide to the Director of the Electric and Hybrid Vehicles Division appropriate evidence that modifications and/or repairs have been made and must also provide substantiating test data to show that the vehicle can meet all DOE Performance Standards prior to re-submittal of the vehicle for test. Following successful verification testing, vehicles already in DOE site operator fleets must be modified and/or repaired in the same manner as the vehicle successfully tested. A modification and/or repair schedule acceptable to the Director of the Electric and Hybrid Vehicles Division must be developed and followed by the manufacturer as a condition for validation of the manufacturers certification.

DOE NOTIFICATION DOCUMENTATION

DOE will notify manufacturers of actions taken during the verification testing process, including but not limited to:

- Receipt of self-certification.
- Notification of vehicle failure.
- Validation or invalidation of certification.
- Final Test Report.

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